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ABSTRACT

This paper describes the experience of making changes to an introductory educational technology course at Florida Gulf Coast University, which has just completed developing new curricula for its initial teacher certification programs. Constructed from the ground up and based heavily on research and theory, the new curricula ensure that technology becomes a core element of every course offering in the new program. The changes in the curricula called for equally dramatic changes in the educational technology course. The paper discusses how the course evolved into its present form, cognizant of the unique mission of the university and the College of Education. (Contains 11 references.) (Author/MES)

Constructing Technology-based Constructivism: A New Approach to the Educational Computing Course

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Abstract: This paper describes the experience of making wholesale changes to an introductory Educational Technology Course for teacher education programs at a state university in Florida, which has just completed developing brand new curricula for each initial teacher certification program it offers. Constructed from the ground up and based heavily on research and theory, the new curricula ensure that technology becomes a core element of every course offering in the new programs. The dramatic changes in the curricula called for, and even inspired, equally dramatic changes in the Educational Technology Course. Just completing the first semester of this new course, the authors discuss how the course evolved into its present form, cognizant of the unique mission of the University and the College.

Introduction

Florida Gulf Coast University's College of Education has just completed a complete curricular revision process in order to receive authorization from the State of Florida to certify teachers. This process has also helped the College ensure that the College will be prepared to work towards the NCATE 2000 standards over the next three years. As Florida's newest state university, FGCU opened in 1997 with a number of important objectives, including the appropriate use of technology throughout all curricula on campus. All of the initial Teacher Education programs were merged into the new campus from a former regional campus of the University of South Florida. Authorized by the state to continue using the USF courses for three years, FGCU has spent the last 18 months preparing for this dramatic change. Since technology is a key component of the campus, state, and national objectives for teacher education, the Educational Technology Course quickly became an important focal point for these upcoming changes.

Florida Gulf Coast University was proposed as a university for the 21st century, and has been built and operated with very high expectations for the use of information technology. A key element of the initial proposal, the strategic plan for technology indicates that FGCU "will constantly embrace information technology in creative, experimental, and practical ways to enhance and maximize the creation and delivery of instructional resources and to develop and strengthen its administrative support systems."

As an additional focus, the university planners established a structure to support Distance Learning as a central part of the university. In doing so, all campus classrooms are now fully connected to the network infrastructure, enabling two-way video to be broadcast to distant locations from virtually any location on campus. The side-benefit of all this "connectedness" is the universal availability of a variety of effective educational technologies to every instructor and every learner on campus.

In November 1999, a new academic building opened which included the first classrooms on campus designed specifically for the needs of Education courses. Modeled by the architects after classrooms they'd built for local middle schools, these classrooms allow teacher-education coursework to more accurately represent the environment graduates will face. Perhaps the most important component of

these new rooms is the inclusion of five-station mini-computer labs. The availability of these computers in almost every classroom where teacher-education courses are taught will enable a new level of technology integration to be realized within the College of Education degree program offerings.

From the outset of the university, Education embraced the wide availability of technology. The first and still only academic unit to operate its own Web and intranet servers, technology was quickly integrated into a wide variety of educational experiences for future educators. More importantly, the emphasis has always been on how technology can support learning, and not simply how to use technology for technology's sake.

Because a core goal of the faculty in the College is to grow towards achieving NCATE accreditation in as short a time as possible, deeply integrating technology into the curriculum has been perceived as essential by virtually everyone. The NCATE 2000 standards are much more stringent in their expectations of technology use, and also expect that technology related experiences are integrated into every course by every instructor. In a 1997 statement on technology, NCATE commented,

> It should be a goal to have every NCATE-accredited institution accessible through the World Wide Web. Web technology can be used to provide information about programs, faculty, courses, and the conceptual model for preparing teachers; to promote and enhance communication between and among faculty and students; to provide students with access to learning resources; and to facilitate the accreditation process, to name but a few uses. Education units at NCATE-accredited institutions should be leading the way in the multiple uses of web technology. Graduates of these institutions should be thoroughly skilled in professional and classroom applications of web technology. (NCATE, 1997)

Designing the Course

When the University opened in 1997, the Educational Computing Course was not an integral part of any degree program. Though it was a required course, it could be taken at any time during the four semesters of a student's degree program (Florida is a 2+2 state). This simple fact created significant problems because students in the classes ranged from entering students to students who had already completed their student teaching experiences. Fortunately, the state changed this required course to a pre-requisite course in 1998, and students are now required to complete this course prior to admission into any Education program.

In its initial format, the course taught David Jonassen's concept of "Mindtools," and used his book *Computers in the Classroom, Mindtools for Critical Thinking* as the core text. Mindtools is grounded in constructivist theory and encourages the use of technology to support active, reflective thinking, Through this type of technology use, students engage in critical thinking to an extent not easily possible without Mindtools, and very different from the traditional approach to the use of technology in learning situations.

Though a very successful course, one continuing problem was that it relied heavily on a text that has proven to be very difficult to access by learners with little or no professional experience in educational environments. Because of this, the course relied on a lecture format to teach the fundamental theory, while relying on a constructive approach to teach the essential computer-related skills like word processing, spreadsheets, databases, and e-mail.

The Need for Change

Near the end of virtually every semester, students would be understanding the idea of constructivist learning enough to ask a rather obvious question: "If the theoretical foundation of this course is to encourage a constructive approach to instruction, why is this course taught primarily in a direct instruction (lecture) format?" The only reasonable answer this author was able to provide was similar to this comment: "When I figure out how to teach constructivism constructively, I will."

These comments nagged this course continuously, more because of their obvious truth than because of any particular obligation to our programs. Teaching constructivism constructively would require that students "construct their understanding" of what the rather complex theory of constructivism means. Add to that, students would also need to add to that construction how computers could facilitate constructive experiences. The course had also always been responsible to teach basic computer skills to all future teachers.

The curriculum development process of the new College of Education focused the instructors on the research and the requirements of NCATE. With the new standards for accreditation, all courses in an Education degree program will be required to integrate technology more than ever before. For the new curriculum, this translated into the Mindtools-style use of technology to teach all of the education courses themselves. If every course in each degree program will implement extensive use of technology, the entire nature of an introductory course in Educational Technology changes. This realization forced the instructors to examine just exactly where this course now fit within the entire program, and what needs must now be filled by this course.

The Research Connection

All new curricula of the College of Education are deeply grounded in constructivist theory. A constructivist approach to learning can utilize technology, allowing students to construct and produce knowledge (Jonassen, 1996). Constructive learning is reflective, and inherently draws on prior knowledge (Duffy & Jonassen, 1992). Jonassen (1996) argues that software tools can help students to organize, reflect on, and assess what they know. "When learners actively construct knowledge, it is more meaningful, applicable, and memorable" (Jonassen, 1996, p. 13).

Piaget's cognitive and developmental perspectives and Bruner and Vygotsky's interactional and cultural perspectives provide the foundation for constructivist learning theory (Driscoll, 1994). Constructivism is rooted in the belief that people are active seekers and constructors of knowledge (Nicaise & Barnes, 1996). "Constructivism assumes that knowledge is built by individuals from within" (El-Hindi & Leu, 1998, p. 3). Jonassen (1996) argues that all learners mentally represent their own reality, and that constructivist instruction must allow learners to actively construct knowledge.

Technology in classrooms has traditionally been used with expensive software that uses repetitive drill to reinforce curriculum (Rice & Wilson, 1999). Computers with even basic software can be used for research, creative thinking activities, organizing ideas, problem solving, and information gathering. Research of any topic has become quick, streamlined, and essentially free for many students (El-Hindi & Leu, 1998). Jonassen (1996) describes the role of the teacher changing from information provider to coach, scaffolder, and problem presenter. Social collaboration is an essential part of the development of knowledge in constructivism as students work with peers to develop their interpretation of their environment. Additionally, students must engage in self-directed learning. The learner must have control over both the direction and content of their learning (Nicaise & Barnes, 1996).

Part of the process of creating an updated course including looking at what other courses are doing around the country. This was accomplished by looking at what others were teaching in similar courses, as reported in the SITE Annuals for 1998 and 1999. Many of the main ideas presented in these articles were similar to these comments:

- "Students were introduced to dozens of different software programs and the educational resources of the World Wide Web." (Gunter, Gunter, and Weins, 1998) - http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_gunt.htm
- "The course content at the four universities provides the education students with the computer concepts and skills which they are expected to know for their future teaching: word processing, spreadsheet, database, multimedia, presentation, e-mail, Netsearch, and integrating technology into instruction. An education student with these computer skills and knowledge will become a qualified teacher who can prepare the children in our nation to face the challenges of the modern world." (Leh, 1998) -http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_leh.htm
- "Several required activities are included in the curriculum that introduce students to word processing, draw, paint, desktop publishing, email, the world wide web, web page development, presentation software, and multimedia. Students are then required to do four projects that expand their knowledge about four of the technologies. The last requirement is a teaching unit in which at least three of the technologies have been integrated." (BUMP, 1998) - http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_bump.htm
- "The learning theory backbone of the class enables them to make decisions about how different types of computer programs can support different learning goals, how to select software that meets learner needs, and how to evaluate new educational technologies from a student learning perspective. The connections they make between learning theories, their own learning, and educational technology provide a solid experiential base that will serve them well in the teaching

profession." (Niederhauser, Salmen, and Fields, 1998) -
http://www.coe.uh.edu/insite/elec_pub/HTML1998/ec_nied.htm

Only a very few courses, such as the last one, appeared to utilize a constructive approach. This was not a lot to go on, knowing that the new course needed to constructively teach both constructivism and the constructive use of technology to support instruction. Instead, the instructors took the best of what we knew about constructivist theory and Jonassen's interpretation of it for Mindtools, and went to work designing a new curriculum.

Establishing the Syllabus

Our first decision was to throw out the book - all books - at least for the first portion of the class. Instead, we decided to teach the course with two stated objectives: first, the course would be a "wash-out" course; and second, the course would have as its fundamental goal how computers can support the construction of knowledge in content areas. These two ideas were a significant departure from previous courses and from many of the courses offered elsewhere (as described above).

Becoming a "wash-out" course was certainly something we deliberated on carefully. We defined this as a course so fundamental to the goals of the larger program that students who failed to do well in this course would recognize that perhaps these particular programs were not a good fit with their skill-base. We believe that technology is simply too important of an element in the preparation of new teachers today to let weak students pass the class. While significant help and assistance is available, we decided to make it very clear at the beginning of the semester that we will not coddle students in the class. Every student is responsible to learn the bulk of the application learning outside of formal class - finding tutors if necessary (just like students in calculus or accounting might).

In the fall of 1999, we also believe that it is now a reasonable expectation that students *enter* our class with basic computer literacy skills. The title of the course clearly indicates that this is "Introduction to Computers *for Education*," not just "Introduction to Computers." Students who do not yet have basic word processing, e-mail, and web surfing skills are to be warned to acquire those skills prior to taking this class. It was important to make it clear that there is now an expectation that students enter the course with a minimal set of computer skills if they expect to be successful.

The sixteen-week semester was broken roughly in half, introducing databases, Inspiration, spreadsheets, and web pages during the first nine weeks, and then interpreting the experience and constructing understanding of the role of technology in education today during the last seven weeks. Most importantly, however, was the nature of the instruction during the first nine weeks. All instruction was designed to be consistent with the concepts outlined in Mindtools as being constructive in nature. That is, every computer experience that was to be provided would be done only though the use of constructivist methodology. A great deal of reflection was also to accompany this instruction.

It must be noted that the most important part of this new course is NOT the instruction of the skills. Rather, it is the modeling of constructive uses of technology to support content learning. At mid-semester students would begin reading a number of carefully chosen articles from a variety of Educational Computing Journals, and discussions would then help students begin to piece together not only the concept of constructivism, but also how technology today is a fundamental aspect of knowledge construction.

Deciding on the topics to be included was challenging. The heart of the course was to be constructivism and Mindtools. Jonassen introduces the Database application first in his coverage of the Mindtools concept, primarily due to its rigid structure and ease of use. We decided to start here as well, but to do so without also trying to introduce an actual computer application (Microsoft Works). Instead, we would utilize a locally programmed web site that provides the ability to manipulate a complete database in a manner very similar to working in an actual database application. Separating the higher-level, constructive nature of database manipulation from the lower-level, skill development process of learning a new program was important to us, and was the reason for leaving the database application out of the initial stages of the syllabus.

Continuing with constructive tools, we decided to introduce Inspiration next. Inspiration is a visual tool for semantic mapping, brainstorming, and many other applications, and Jonassen's text emphasizes the importance of using this type of tool to help students reflect on what they know, and how they know it. Providing more direct experience with this tool would be important since it is new to virtually all students. Nevertheless, students would still need to be responsible to utilize the help files and other resources to master the program. Constructive learning is student centered, not teacher directed.

Two additional tools would be introduced, spreadsheets and the web, and like the first two, would be taught only minimally, requiring the learners to seek out the help and advice necessary to be successful in the learning process. Finally, the course would conclude by using recent journal articles to tie these experiences together and facilitate the construction of the courses "big ideas."

Teaching the Course

We were prepared for resistance. Most of our students are choosing to enter teaching and report that they enjoyed school and how they were taught. Since most schools today still generally employ directed instruction methodologies, most of our students are actually reporting that they like being taught to in a directed instruction style. Our very first statements in class warned students of the rather dramatic change in instructional style from what they might be used to or comfortable with, and included a discussion of how most students preferred to learn. We were careful not to "give away" our philosophy, but helped students reflect on their learning experiences to date. Students were also warned about the need to have basic technology skills upon entering the course, and also about our approaching this class as a "wash-out" course. (We lost a handful of students from the first to the second sessions of each course section.)

Once we began covering the actual course topics, students experienced our methodology right away. Students were expected to set up their own e-mail accounts (on a university web page), and then to send e-mail the first night. They were given an assignment to "experiment" with the e-mail software. Although we briefly discussed what the email was capable of and what some of terms meant, specific instructions were not provided. The help files were introduced, as well as the concept of working with a partner, where to go for help (the computer lab), and how to find e-mail at home to do some of the same things that we encouraged them to explore (mailing lists, sending attachments, etc.)

Next we had the students begin exploring the databases. Our discussion of databases began before the actual use of one, which followed closely with the Jonassen text as to their uses, functions, etc. Later, we introduced the online database, and briefly introduced the concepts of sorting and filtering. Students were given time to "play" (experiment) with each of the tools, followed by a structured time to reflect on how a database could be useful to learning. Through this process, students were encouraged to make some statements (predictions) as to why the databases (and their tools) are useful, how could they be used with content, what conclusions learners could make from manipulating this data, and how students might use them to better understand information that they might be given or the might collect. During the third session, only after students were provided adequate time to process these "big ideas" about the constructive use of databases, a database management application was introduced (MS Works). The program was modeled extensively in the classroom, but only basic instructions on how to use this tool were provided (along with reminders where help was available).

Each major tool, Inspiration, Spreadsheets, and the Web, were introduced in a similar fashion. Very little direct instruction was provided, although extensive resources were made available and office hours were clearly identified.

Constructing Constructivism

Throughout the semester we faced students unhappy with the amount of "support" we provided. Conditioned to a direct instruction learning format, students expected to receive direct and specific instruction on skills needed for the class rather than guidance on how to gain these skills on their own. Weaning students from the expectation that all information and skills they needed would be provided to them caused the expected strife and yet also set up some interesting discussions among the students. However, conditioned also that learners only have to answer predictable questions in class, truly engaging discussions were difficult to start and sometimes even more difficult to continue. As might be expected, non-traditional students were typically the most responsive and the largest participators in class discussions. Students who reported that their high-school learning experiences involved little direct instruction (only a handful of students reported this) were also the most receptive to the ideas introduced.

The essence of the course, the whole purpose of its existence, was to be found in the students' ability to construct a conception of constructivism. We note here the difference between "getting it" and "buying it." Our goal at this early stage of their professional education program is to help students' "get it" so that we might initiate the *process* of "buying in" to the theoretical foundation that underlies the rest of

our curriculum. As noted earlier, we did expected resistance. In fact, we expected a lot of it. And resistance is just what we found. Interestingly, though, only late in the semester did resistance to the concept itself begin to develop. We perceive this as positive because in order to resist the underlying concept, the concept itself needs to be understood to some extent. Since understanding the concept was the primary goal at this point, we feel like we have achieved a level of success we had not achieved in prior semesters using the more directed approach.

Continuing the Course

As with any new program, there are kinks to be worked out. At the time this paper is being written, the semester has two weeks remaining. Final projects need to be negotiated and completed, and the entire semester reflected upon. Ongoing discussions with the students have pointed out a number of areas to work on for next semester, including the need to significantly modify the expectations for any spreadsheet projects and also the consideration of using Inspiration as the initial software application.

Other challenges exist for the upcoming semester, including a new instructor who comes to the course with limited experience in enabling constructivist learning in the classroom, and an increasingly older set of lab computers that are less able to support our growing needs. In addition, as a 2+2 state, we will begin working with our local community college to encourage a consistent approach to this common course for students completing this pre-requisite as part of their Associates Degree.

Conclusions

The Educational Technology Course has become a foundational course in the development of professional educators, but not in the way that many believe. Too many programs still approach this type of course as the one chance to be sure that prospective teachers acquire the majority of technology instruction they'll ever need. This approach is too narrow, and will simply fail to meet the requirements of NCATE 2000, not to mention the needs of the future teachers themselves. Teachers must acquire and continue to develop skill in computers and computer related technologies throughout their entire set of professional coursework. To do any less cheats not just these learners, but cheats every future student of each of our graduates.

This new recognition of the role that technology will play in every teacher education course places an entirely new set of expectations on the Educational Technology Course. Simply providing a core set of specific skills will not enable success in our new curriculum. Instead, this introductory course now serves the purpose of beginning a transformation in future teacher educators from a consumer of information to a constructor of understandings, and from a mere gatherer of facts to an active constructor of knowledge, all facilitated by the power of computers used as Mindtools.

Recently, the College of Education adopted a "Statement on the Use of Technology" which will appear in all future University Catalogs. In a few sentences, it captures the fundamental reason for redesigning the Educational Technology Course in the format that we have. It states, in part, that the College "does not treat the variety of technologies used in the education process as a separate subject or content. Instead, technology is merely one additional means of facilitating the educational process within the College and within the educational communities our programs serve. Because of this philosophy, we expect all learners to be proficient with education related technologies.... Technological proficiency is expected as a pre-requisite skill, similar to the expectation that all learners can write, use appropriate grammar, and access library resources."

The role of technology in learning has changed dramatically in the last few years. The role of the Educational Technology Course must change even more dramatically if we expect to be able to provide teachers prepared for the challenges of the 21st century learning environment.

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